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Wi-Fi Optimization with Wireless Mesh Networks

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Abstrak

Wifi merupakan salah satu teknologi yang masih bisa merambah ke beberapa layanan di sekitar kita. Perlunya layanan tambahan berupa wifi trigger kami untuk memberikan solusi peningkatan kualitas, keamanan bahkan jangkauan. Dengan menggunakan single access point biasa, kinerja wifi menjadi tidak maksimal karena adanya interferensi antara sinyal dan kekuatan atau diselingi dengan wifi repeater. Titik akses memerlukan lebih banyak daya untuk memperluas jangkauan. Dengan jaringan mesh, kinerja access point bisa lebih maksimal. Penelitian ini menunjukkan bahwa implementasi mesh dapat meningkat dari -20dB di bawah hingga di atas -50dB atau lebih dari 100%. Dengan jaringan mesh wifi dapat dilihat dalam satu SSID yang berbeda dengan repeater yang mempunyai jangkauan dan setting tersendiri. Jaringan mesh menghubungkan semua klien secara mulus ke node dekat dalam SSID jaringan tunggal.

***Kata kunci** : Acces Point; Jangkauan; Jaringan Mesh; Penyederhanaan; Wi-Fi.*

Abstract

Wifi is one technology that can still penetrate into several services around us. The need for additional services in the form of our wifi trigger to provide solutions to improve quality, security and even coverage. By using an ordinary single access point, the wifi performance is not optimal because of the interference between signals and the strength or in between with wifi repeater. Access point need more power to extend range. With a mesh network, the performance of the access point can be maximized. This research shows that mesh implementation can increase from -20dB bellows to above -50dB or more than 100%. With mesh network wifi can be seen in single SSID different with repeater that has own coverage and setting. Mesh network connecting all client seamless to near node in single network SSID.

***Keywords :** Access Point; Coverage; Mesh Network; Simplification; Wi-Fi .*

1. INTRODUCTION

Wifi Risk Report by Norton in 2017 [1] provides some interesting results, including Over half of the people admit to using WiFi to log into their personal email (59%) or social media accounts (56%), apart from doing other things like sharing photos or videos (44%). Public Wi-Fi is available in a variety of public places like libraries and restaurants. What is even more interesting and definitely worth noticing for businesses, is that people make purchasing decisions based on the availability of the WiFi signal. As per Norton's report, it is a “deciding factor” for their choice of a hotel (71%), transportation method (46%), dining place (43%), and airline (also 43%).

In line with Norton Report J.Kovar [2] in his dissertation revealed the effect of complement service wifi from a restaurant. Still using the research restaurant object from Jiyeon Jeon [3] using the millennial generation as research material. Cobanoglu Research [4] also revealed that about 70% of people prefer their café or restaurant to have a hotspot, proving that hotels are not the only ones in the HoReCa industry that can greatly benefit from offering free WiFi. 28%, or almost one-third of all retailers, confirmed that by offering guest WiFi they improved their customer loyalty. In the transportation sector by jinhyun H [5] prove that offering free WiFi may encourage commuters to leave their car in the parking lot. More broadly, the valuation value based on the Wi-Fi Alliance report [6] globally in 2023 will reach $ 3.5 trillion and is expected to reach $ 4.9 trillion in 2025, from this figure it can be estimated that the magnitude of the impact of wifi.

Broadly speaking, wifi uses high-frequency bands [7], this has an impact on a greater data rate so that the bandwidth becomes larger as well. However, these advantages are inversely proportional to the range of radio frequency transmission used. Limited distance and signal penetration of obstacles such as tree walls and other disturbances [8], so wifi is said to be less agile. Several solutions have been offered [9], [10] however, in this study, we try to combine the mesh technology used in cellular communication into wifi technology.

2. METHODS

Figure 1 shown our experiment in a room with 15x5 m2. We place a new 2 (two) node with custom operating system in 2 node as wireless access point as seen in Fig 51. Before modification, this room have only one access point that work in this room. The access point we use is ubiquiti AC AP SHD as seen in Figure 2.

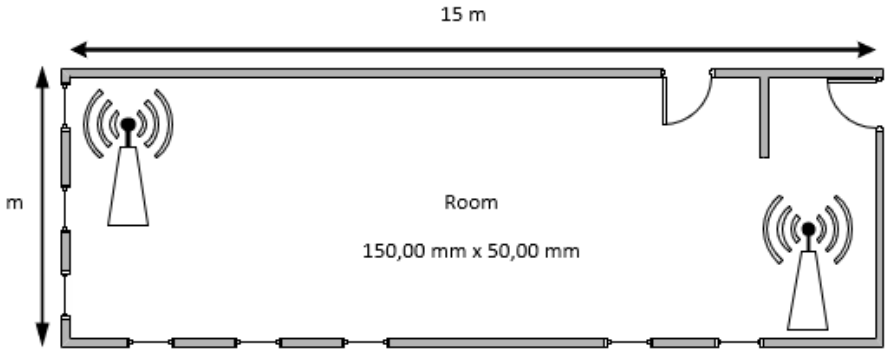


Figure 1 Access Point location

Figure 2 Access point for WMN

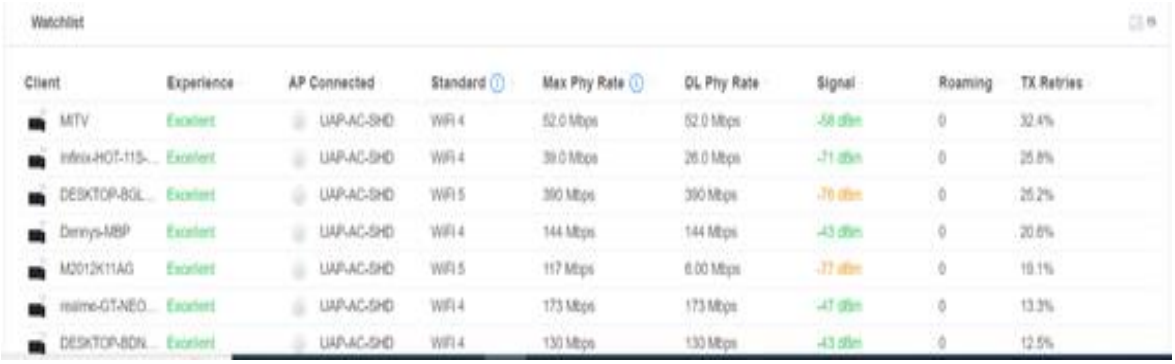


Figure 3 Access point for WMN

We can scan environment what access point neighbourhood and user connected to access point. Scanning process shown in Figure 3. As seen in Fig 3 also that every user that connect to this access point have a range -47 dB into -76 dB. Table II shown standard for signal strength. This experiment want to improve the signal to maximum. It means below -30 dB and get max achievable signal strength. First thing first a new operating firmware for the router and modification antenna and system.

This prototype deploy with minimum ones that using 2 node. Figure 4 shown Realtime signal to noise after modification signal and antenna. Figure 5 shown node scan from that firmware. As describe above even though using the new firmware and a good antenna, the connectivity between 2 nodes is below -20 dB, that we can achieve maximum signal. The modification was continued by merging with the mesh network concept.

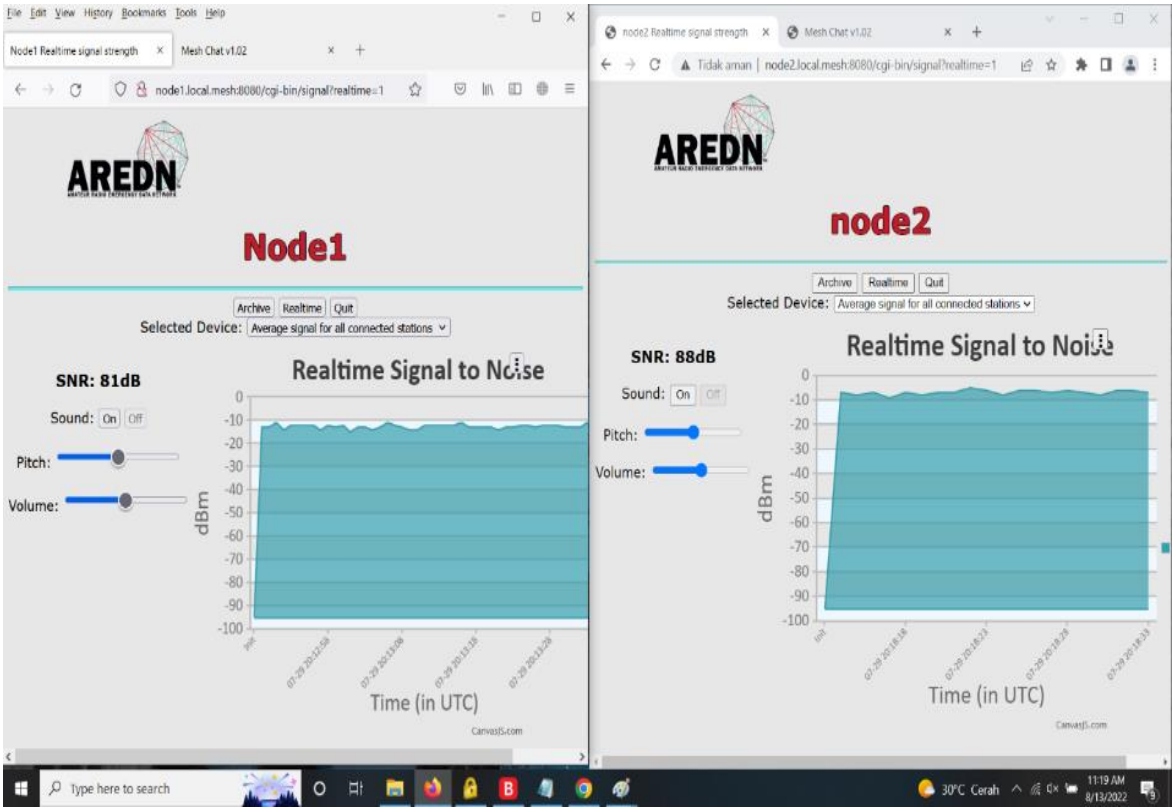


Figure 4 Realtime to Signal Noise

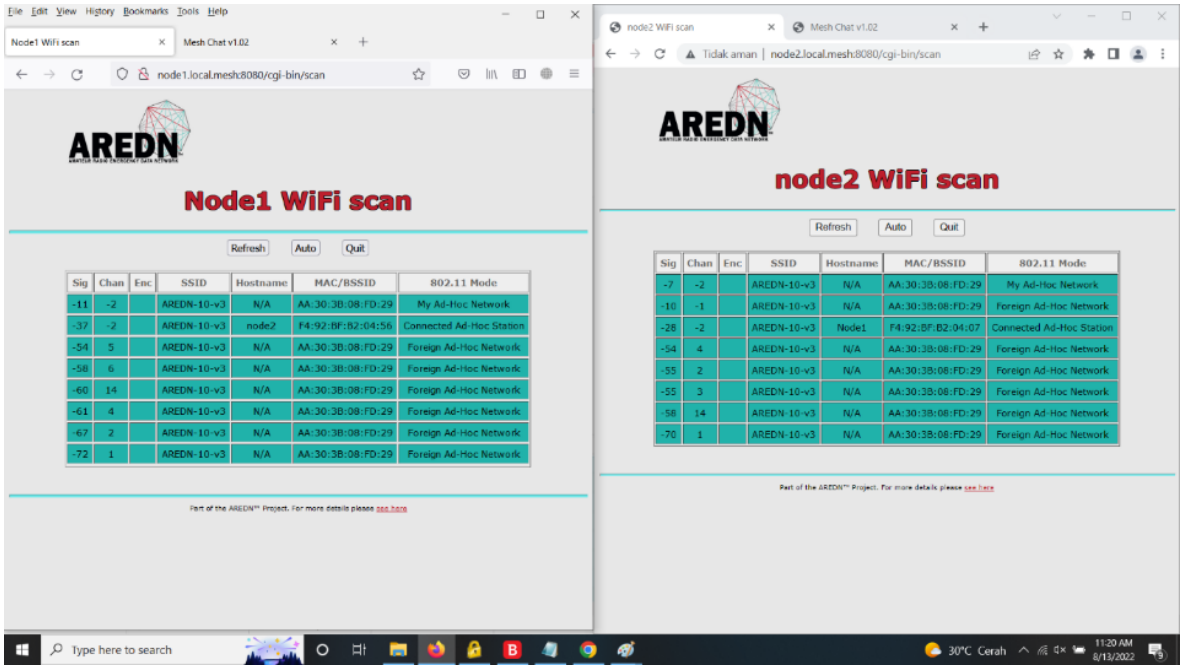


Figure 5 Node Scan

3. RESULTS AND DISCUSSION

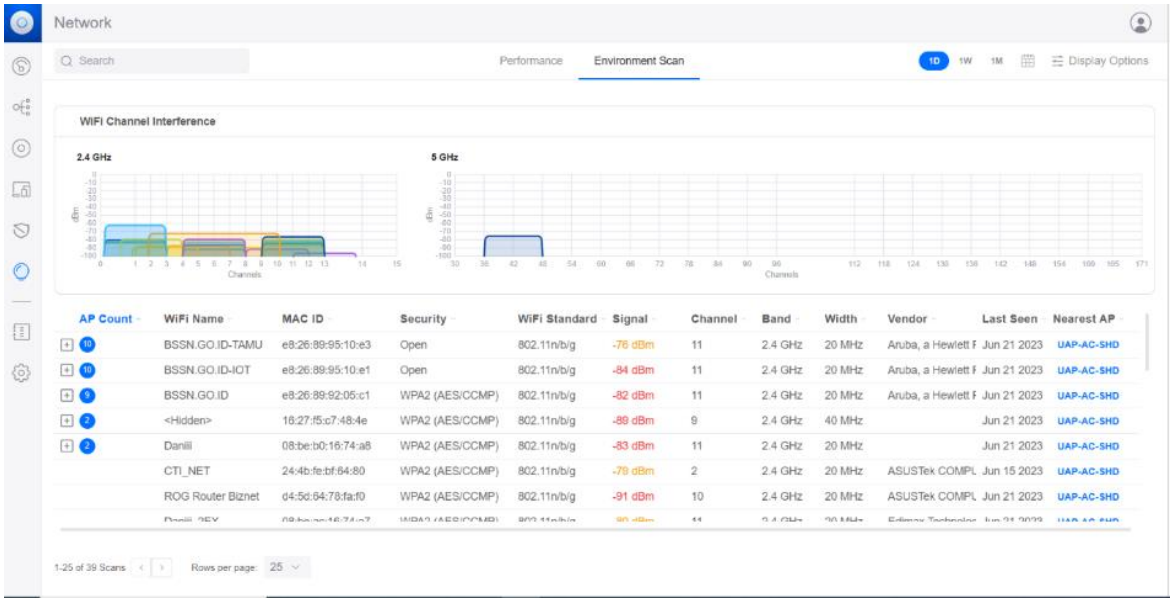
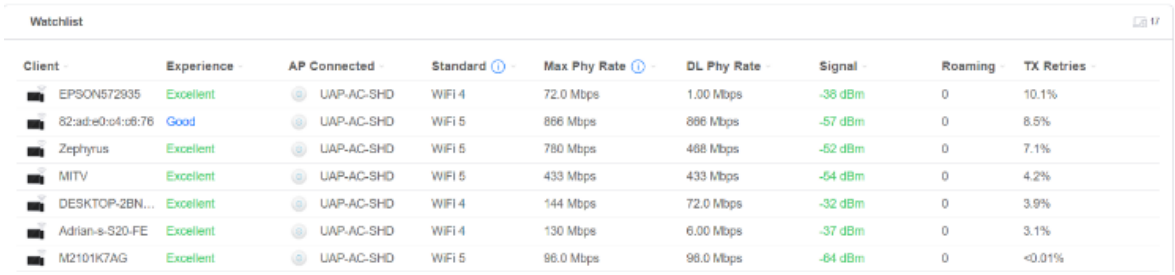


Figure 6 Signal Interference

Before merging, scanning is done first to see the existing signal interference. Fig 6 shows quite dense interference at 2.4 Ghz frequency. Merging nodes into a mesh network results in a significant increase in signal strength as shown in Figure 7. By using an ordinary single access point or in between with wifi repeater, the wifi performance is not optimal because of the interference between signals with another or with repeaters instead and the strength of 1 access point which requires a lot of power to cover more. With a mesh network, the performance of the access point can be maximized, with nodes 1 and 2 that are connected and low signal interference in single SSID and seamless connected to client to near node.


Watchlist

Client	Experience	AP Connected	Standard	Max Phy Rate	DL Phy Rate	Signal	Roaming	TX Retries
EPSON572935	Excellent	UAP-AC-SHD	WiFi 4	72.0 Mbps	1.00 Mbps	-38 dBm	0	10.1%
82:ad:e0:c4:c6:76	Good	UAP-AC-SHD	WiFi 5	866 Mbps	866 Mbps	-57 dBm	0	8.5%
Zephyrus	Excellent	UAP-AC-SHD	WiFi 5	780 Mbps	468 Mbps	-52 dBm	0	7.1%
MITV	Excellent	UAP-AC-SHD	WiFi 5	433 Mbps	433 Mbps	-54 dBm	0	4.2%
DESKTOP-2BN...	Excellent	UAP-AC-SHD	WiFi 4	144 Mbps	72.0 Mbps	-32 dBm	0	3.9%
Adrian-s-S20-FE	Excellent	UAP-AC-SHD	WiFi 4	130 Mbps	6.00 Mbps	-37 dBm	0	3.1%
M2101K7AG	Excellent	UAP-AC-SHD	WiFi 5	96.0 Mbps	96.0 Mbps	-64 dBm	0	<0.01%

Figure 7 Wifi mesh signal strength result

4. CONCLUSIONS

The nodes in WMN are self-configurable and self-healable. Such self- configuring nodes are better which improves the system performance, whereas self-healing makes the network to reconfigure if there are any addition and deletion of nodes in the network. Due to the huge number of nodes and data, there will be a high fault tolerance and degradation in performance. Integration of existing network leads to more complexity. By eradicating these drawbacks, the performance of WMN can be enhanced.

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